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AUTHOR Novillis, Carol F.
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ABSTRACT

Presented is a review of linguistic research on children's acquisition of more/less, same/different, big/little, long/short, and similar relational and dimensional terms. The review illustrates that children's meanings for words differ from adult meanings. The nature and findings of several research projects are discussed and it is concluded that while there are many limitations to the studies reported, there are several general and specific trends worth noting. Children's first meanings for terms can be viewed as incomplete and incorporating additional features as part of their meaning that are not part of adult meanings. Teachers of young children should be aware of the many diverse situations in which terms are used, and should listen more to children in natural language contexts where they exhibit spontaneous use of terms. The stated purpose of this paper is to emphasize the need for mathematics education research that focuses on lingusitic variables as well as cognitive ones. (MP)

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THE MEANINGS OF SOME RELATIONAL AND DIMENSIONAL TERMS IN CHILDREN'S LANGUAGE

Carol F. Novillis

University of Arizona

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Abstract

A review of the linguistic research on children's acquisition of more/less, same/different, and some dimensional adjectives illustrates that children's meanings for words differ from adult meanings. The purpose of this review is to emphasize the need for mathematics education research that focuses on linguistic variables as well as on cognitive ones.

The Meanings of Some Relational and Dimensional Terms in Children's Language

The purpose of this paper is to acquaint mathematics educators with some of the linguistics research on children's acquisition of relational and dimensional adjectives. This review of literature is intended to emphasize the necessity of attending to children's meanings for words when investigating children's mathematical concepts. This review will show that the results of investigating young children's meanings of terms such as more/less, same/different, big/little and long/short illustrate that children do not have adult meanings for words. This means that the usual assumption made when two adults are speaking cannot be made when one of the parties is a young child. This assumption is that both speaker and listener have approximately the same meanings for the words being used. These studies also show that it sometimes takes years before children's first meanings for words develop into complete adult meanings. In the intervening time the children's meanings for words change; sometimes in the direction of the adult meaning, but at other times there appears to be a loss of parts of the meaning of a word that had previously been acquired.

Relational and dimensional adjectives were chosen to demonstrate development of word meaning in young children since they are consistently used in most Piagetian conservation studies. Decisions as to children's cognitive level seem to be based on the assumption that children have the same meaning for the terms more, same, longer, etc. as do the adult investigators. The validity of decisions as to children's cognitive development must be questioned when the children's meanings of the relevant relational and dimensional terms, as well as other key terms are not also investigated. Failure on conservation tasks may indicate that children can't conserve, lack lexical knowledge, or both.

Consider the following child's responses to the standard conservation of length task where two identical sticks of equal length are compared and then one is moved forward:

Examiner (E): (Shows Ruf (4;6) two sticks the same length with their extremities facing each other.) "Are they the same length or is one longer than the other?"

Ruf: "They're the same length."

E: (Moves one stick forward 1 or 2 cm.) "Are they the same length or is one longer than the other?"

Ruf: "It's bigger because you pushed it. The stick is longer" (Piaget, Inhelder, & Szeminska, 1964, p. 95).

What are Ruf's meanings of the words length, bigger, and longer in this exchange? There is no way to tell from the information given. Can it be assumed that Ruf has the full adult meaning of these terms? What are other possibilities? Ruf might be associating the terms length, bigger, and longer only with some notion of size; or he might be using bigger and longer as synonyms. Another possibility is that Ruf could be using bigger and longer as synonyms for big and long. These possibilities can be supported by research results to be presented in this paper. The point is that it is difficult to determine the child's meanings of these terms from these few statements. This discussion is intended to raise some questions in order to emphasize the need to investigate children's meanings of terms when investigating their conceptual development or the development of their mathematical concepts.

Once mathematics educators decide to investigate word meaning, an important consideration is designing research protocols that will be as free of task variables as possible. Some of the studies reviewed in this paper have been

criticized because of certain aspects of their design. The investigation of children's acquisition of word meaning is a new field with much of the research having taken place in the last ten years. Hence researchers in this area are in the process of developing effective research strategies. In order to aid mathematics educators who wish to begin to do research in this area questions as to research design raised by later investigators and myself will be included in this paper.

The following review of the literature will be organized by the terms being investigated: more/less, same/different, and the dimensional adjectives. Each of these sections will have two subdivisions: a) a discussion of the meanings of the terms and other linguistic characteristics that have been explored as being relevant to children's acquisition of these terms and b) the results of some of the research on children's meanings of these terms.

More/Less

Meanings of More/Less

Researchers who have investigated children's meanings of more and less have attempted to describe the adult meanings of these terms. They have also identified what appear to be some linguistic characteristics of these terms that might be related to their order of acquisition.

More is the comparative form of the adjectives much and many. Much refers to amount and many to number. Less is the comparative form of the adjective little. Little can mean small in amount or number. Hence more and less can be used in comparisons of both discrete units and continuous quantities.

More and less denote quantitative relations in the sense of "greater than" and "less than". As relations more and less are both irreflexive, assymetrical, and transitive. Beilin (1975) states that these relational properties are more like the properties of first and second than those of one and two. Hence he

classifies them as ordinal number-words rather than as cardinal number-words even though they apply to both series and classes.

Oppositeness of meaning is an important semantic relation between terms. Lyons (1968) describes three types of oppositeness: complementarity, antonymy, and converseness. He states that two terms are complementaries if "the denial of the one implies the assertion of the other and the assertion of the one implies the denial of the other: $\sim x \supset y$ and $x \supset \sim y$" (p. 461). Two terms are antonyms when only the second of these implications holds. More and less are antonyms since: A is more than B implies the denial of A is less than B; but the denial of A is more than B does not imply that A is less than B, for A equals B is another possibility.

In pairs of antonyms one term is usually considered to be semantically "marked" in terms of the other term in the pair. The "unmarked" term is the one that can be used in both a nominal and a contrastive sense. For the pair much/little, much is unmarked and little is marked. In the question "How much money do you have?" much has a nominal (neutral) meaning referring to amount in general. The question does not imply that you have a great deal of money, but simply asks for the amount. Whereas the question "How little money do you have?" is contrastive, the implication is that you have little money (H. Clark, 1970).

Markedness is often related to another linguistic characteristic, polarity. Lyons (1968) discusses this relationship for certain antonyms:

> The fact that the distinction between antonyms is neutralized in certain syntactic positions contributes, no doubt, to our feeling that one antonym has a 'positive', and the other a 'negative' polarity. We tend to say that small things 'lack size' rather than large things 'lack smallness'. And, in general, the 'unmarked' antonym is used for what is felt as 'more than', rather than 'less than', the norm (p. 467).[1]

Markedness and polarity play a very important role in the research to be presented. E. Clark (1973a, 1973b, 1975, 1977b) has predicted that children will first acquire the meaning of the positive, unmarked term in a pair of antonyms because it is linguistically less complex. She further predicts that when children first begin to use the marked, negative term they treat it as a synonym of the unmarked term. Some of the studies reported in this paper form part of the basis for this theory; and others were undertaken to prove or disprove Clark's hypothesis.

One theory of linguistic meaning is based on the notion that each word is a collection of basic elements of meaning called "semantic markers" or "semantic features" (See Katz & Fodor, 1964). In this theory antonyms share all semantic features except for the contrasting value of polarity. In order to differentiate between antonyms the child needs to attend to this one difference.

More differs from less in another way in that it is ambiguous. It can have an "addition" sense as well as a "comparative" sense. One can say "Give me some more" but not "Give me some less".

Donaldson and Wales (1970) and Harasym, Boersma, and Maguire (1971) claim that making a judgment of more or less requires two levels of judgment. The

first requires that a judgment of difference be made, which is a qualitative comparison: "Are they the same or different?" The second judgment, a quantitative comparison, is made only if differences are seen. This second judgment is a decision as to the relative magnitude or direction of the difference.

The adjectives more/less are used in many diverse situations. Identifying these situations has been important in order to design research tasks that will help to uncover children's meanings of these terms. Donaldson and Balfour (1968) offered the following analysis:

1. More/less may apply to discrete units or to continuous quantities.

2. More/less may be used to compare one entity across time, two entities at a given point in time, or two entities across time.

3. When comparing two entities across time various types of changes may or may not take place. When change occurs either one or both of the entities may change. If both change, both may increase or decrease, or one may increase and the other may decrease. In the latter case the changes may be related or independent. They are related if a transfer is made from one entity to the other. The results of a change may or may not require a change in the initial judgment. The directions of the change may or may not be in accord with the final state of the two entities relative to one another.

4. When change occurs the person making the comparative judgment may or may not make the change himself.

Other possibilities for change involve changes in irrelevant variables coupled with changes in quantity or occurring without them.

Some of these situations are more complex than others. Some of the studies reported in the next section investigate children's meanings of more/less in only one of these situations and some across many diverse situations.

Research on Children's Meanings of More/Less

Many of the first studies of children's meanings of more/less were conducted in the context of investigating Piagetian conservation of number tasks. As a result it is somewhat difficult to interpret the results in terms of children's meanings of more and less. For example, Mehler and Bever (1967) first had children agree that two rows of four clay pellets had the same number. They then added two clay pellets to one of the rows of four and at the same time made that row shorter than the other row of four. Two-year-olds did best on this task with scores decreasing for each age group reaching a minimum in older 3-year-olds, with the 4-year-olds then showing an increase in performance. They conclude from these results "that the inability to conserve quantity is a temporary phase in the developing child" (p. 158). They also imply that the children that selected the row of six clay pellets understood the relational sense of more. Beilin (1968) disagrees that children as young as 2 to 4 years of age understand the relational sense of more. Beilin claims that the children were choosing the correct set because they saw more pellets added to the set. It is generally accepted that the "addition" sense of more is learned prior to the "comparative" sense. Weiner (1974) reports Bloom's (1970, 1973) discovery that young children (12-23 months) first used more when an object (or event) reoccurred after it had disappeared (or ceased) and to indicate another instance of an object that was already in the child's presence. These seem to be related to the adult meaning of more in its "addition" sense.

In order to support his criticism of Mehler and Bever's (1967) interpretation of their results Beilin (1968) designed a study to test 3- and 4-year-olds' ability to deal with more (a) in the additive sense of more of, (b) in the relational sense of more than in a static situation, and (c) in the more than sense when there was a transformation. The additivity concept more of is the only one that showed a positive age trend where the correct responses were greater than chance. Beilin's results were contrary to those of Mehler and Bever (1967), but Beilin did not include 2-year-olds in his study. In response to Beilin's criticism Bever, Mehler, and Epstein (1968) replicated the Mehler and Bever (1967) study making a crucial change. This time they did not allow the children to observe them add the pellets and rearrange the row with more. Their results were similar to those of the original study. The main concern of these three studies was ascertaining if very young children could conserve number. Because the term more was used in the questions asked, the researchers made claims as to children's understanding of more in a relational sense. Yet, so many variables were involved, it is very difficult to ascertain if the children were responding to the term more or if they had perceptual preferences for one type of arrangement over the other.

Donaldson and Balfour (1968) conducted the first study that was directed solely toward discovering children's meaning of more and less in comprehension tasks. Fifteen children aged 3;5 to 4;1 were presented with eight different stimulus situations for each term. Used in all situations were two cardboard apple trees, each having six hooks and twelve cardboard apples which could be hung on the trees. Static and changing situations were used. Sometimes the

children were asked to judge a change and sometimes they were asked to make a change. The most consistent findings was that children were not differentiating less from more. Directions and questions containing the term less were responded to in a way that would be correct for more. Only one child consistently answered less questions with success. Overall there was inconsistency in children's responses to both more and less questions across tasks. As the tasks became more difficult children became confused. Donaldson and Wales (1970), in discussing the same study, report that in the active tasks children almost always added apples to the tree whether the directions of "make it so that there are more (less) apples on this tree than on this one" (p. 246), contained more or less.

A second study was conducted six months later by Donaldson and Balfour with 14 of the same children to discover if the children's meaning of less had changed. In this study only one apple tree was used and children were directed: "Make it so that there are less apples on the tree". When children were presented with 4 (3) apples on the tree and 2 (3) apples lying on the table, seven children consistently added more apples to the tree. The one child who was successful with less in the first study was the most successful on this task. The other six children subtracted apples on at least one of the four trials, but in some cases then put them back on the tree. Three of these children expressed doubt that they were performing correctly. Although they were still largely incorrect they indicated perplexity at their responses which was notably absent in the first study. This would seem to indicate that they were beginning to differentiate between more and less.

Donaldson and Wales (1970) report that records were made of these 14 children's spontaneous speech for 11 months at the nursery school that they attended. In that time only six utterances contained the word more and none contained the word less. Only two of the uses of more were of a "comparative" sense and these were both produced by the only child who consistently comprehended less in the two studies. The other four utterances contained more used in an "addition" sense.

Palermo (1973) replicated Donaldson and Balfour's (1968) study with two groups of 16 children with mean ages of 3;9 and 4;5 years. Besides using the apple tree tasks for discrete units, he also used glasses of water for testing more/less with a continuous substance. All but two of the children were successful on the more tasks. Ten children were successful on the less tasks. The other 22 children consistently behaved as if less meant the same as more, replicating Donaldson and Balfour's (1968) findings. Overall there were no differences on discrete and continuous tasks. The older children were more successful than the younger children, especially in response to the less questions. Performance of individual children varied little with the particular situation; Donaldson and Balfour (1968) report a great deal of inconsistency between tasks. A possible explanation for this difference is that Palermo (1973) used two trials for each situation, whereas Donaldson and Balfour (1968) varied the number of trials usually stopping when the child refused to continue the task.

Palermo (1973) also conducted a second similar study with school-aged children (kindergarten - second grade). All children responded correctly to the more questions. On the less tasks children fell into three groups:

(a) those who did not know what less meant, (b) those who knew what less meant, and (c) those who were in transition. These children were also administered an abbreviated semantic differential. They were asked to rate the words more and less on a five point scale for the dimensions: low/high, long/short, wide/narrow, big/small, thin/fat, and up/down. The mean scale values for the three groups according to their knowledge of less provide support for the children's failure to differentiate more and less. The group who knew the meaning of less showed a definite expected differentiation between more and less on the semantic differential. But the semantic differential values for more and less for the group who did not know less are very similar, and both resemble the expected profile for more. This result is in direct conflict with an earlier result obtained by Harasym, Boersma, and Maguire (1971) when they administered this same semantic differential. They assigned 60 first-, second-, and third-graders to three groups based on their performance on six conservation tasks: nonconservers, intuitive conservers, and logical conservers. The profiles of the mean scale values for the logical conservers were opposite each other and as expected; but the nonconservers did not distinguish more from less. The nonconservers' profiles for more and less both resembled the expected profile for less. This is directly contrary to what would be expected considering the results of Donaldson and Balfour (1968) and Palermo (1973).

Other data conflict with the theory that children's first meaning for less is as a synonym for more. Weiner (1974) investigated if there was a relationship between children's acquisition of the "occurrence" sense (addition sense) and the "quantity" sense (comparative sense) of more and related meanings of less. A major result was that children's performance in the

transformation conditions did not differ significantly from their performance on the static condition for both more and less. For these children adding and subtracting objects to one of the sets being compared did not lead to the better performance expected. The second major result was that children's comprehension of more developed earlier than their comprehension of less. This is consistent with most previous studies reported. There was an age difference on children's comprehension of both more and less. Even though most subjects did not comprehend less, the majority did not behave as if they thought it meant more. Eleven of the 86 children did respond in this pattern. Weiner attributes this to a non-linguistic preference for longer rows. She reports that these children tended to point to the longer row even before a question was asked.

Weiner (1974) further tested 24 of the children on their ability to make static quantitative comparisons when the terms more and less were not used. Children were presented with two unequal rows of toys and told to chose one for themselves and one for the experimenter. It was assumed that they would want to keep the row with more and give away the one with less. Children were more successful at this task than they were overall on the tasks using more and less questions.

> Thus it is possible that Ss could have succeeded merely by deciding which row had the greater quantity and giving E the other row without ever making the converse judgment. Indeed, the development of the linguistic ability to understand "quantity" more and the relative difficulty of less could be considered a direct result of the cognitive, nonlinguistic factors enabling the development of simple quantitative, relational judgments (Weiner, 1974, p. 286).

The results of an earlier study by Griffiths, Shantz, and Sigel (1967) adds to the confusion surrounding children's difficulties with less. They studied children's (aged 49 to 62 months) ability to produce and to comprehend the terms more and less using tasks involving number and weight. These children did not experience the difficulty with less reported by other researchers. More was significantly easier for weight than for number (92% correct responses vs. 72%). When looking at individual responses across tasks 80% of the children were correct on both weight and number tasks.

Palermo (1974) designed a study to investigate if the type of comparison made was a reason for the conflicting results of children using less as if it meant more reported by Donaldson and Balfour (1968) and Palermo (1973) but not by Griffith et al. (1967) and Weiner (1974). Palermo (1974) tested 32 3- and 4-year-olds' knowledge of less using five different types of tasks similar to those used in these four studies: apple trees, water glasses, weights, linear arrays, and M & M's in cups. Four-year-olds performed better overall than did the 3-year-olds, but there were no significant differences between tasks. Similar to findings by other researchers, children fell into two clear groups: those who knew less and those who did not know less. Only three children were in transition. Palermo again claimed that children unhesitatingly responded to less as if it was a synonym for more. But as in the previous studies that have made this claim, the children were told to choose between only two situations. So a child either made the correct choice or was forced to choose the more response. The task did not really permit any other pattern of response.

This fact motivated Wannemacher and Ryan (1978) to design a study to discover if 3-, 4-, and 5-year-olds simply do not understand less or are using it as a synonym for more. One comprehension task consisted of asking the child to select the one with more, less, not more, or not less than an indicated standard. The stimuli was a vertical array of three to six columns of beads on rods attached to a wooden base. All more and less distinctions were easy for each age group. No differences were found due to number of response alternatives; and to whether or not the rods were removed after they were chosen. The negative questions were more difficult, with only the not more questions differing significantly from chance for the 4- and 5-year-olds. This adds to the evidence that the meaning of more is acquired before that of less. Less was easier for children in this study than in many of the other research studies, and children did not respond to less as if it meant more. This difference in results may be related to the fact that this study differed from previous studies in that (a) children were given an explicit standard, and (b) more and less were always tested on the same trial. Donaldson and Balfour (1968) tested more and less on separate days, Palermo (1973) tested more and less in separate trial blocks, and Palermo (1974) tested only less. Other studies that report young children having a good understanding of less also tested more and less on the same trial (Beilin, 1965; Griffiths et al., 1967). Another facilitator seems to be the linear arrangement of the array.

Holland and Palermo (1975) lend support to the fact that using more and less together seems to facilitate children's comprehension of less. Sixty-two 5-year-olds who did not know the meaning of less were assigned to a control or to an experimental group. Children were also pre-tested on a variety of

conservation tasks. In the training session the children in the experimental group were repeatedly asked to make more and less distinctions for the same pair of stimuli. All but three of these children succeeded in learning the meaning of less, whereas only two children in the control group improved their performance on the less post-test.

> The surprising outcome of the training session was the speed and ease with which children learned the appropriate reference for "less": most were responding correctly and unhesitatingly to "less" questions by the end of the first part of training and were then able to answer questions and solve problems of more difficult tasks without further training (p. 441).

Even though children learned the meaning of less, they did not improve performance on the conservation tasks. Based on this lack of improvement on the conservation tasks Holland and Palermo conclude that "the ability to dinstinguish 'less' from 'more' is not linked in any sufficient or necessary way to conservation abilities" (p. 443). One problem with this conclusion is that the post-test was administered between one and five days after the training session. It seems that a retention test administered at least one month later would be a better indicator that the change in meaning was internalized and permanent. Also many various types of tasks would need to be administered in order to conclude that children had an adult meaning of less.

Children's responses to the various types of tasks administered by Wannemacher and Ryan (1978) revealed that children respond differently in contexts when the response alternatives are provided (restricted contexts) than in contexts when possible answers are not given (unrestricted contexts). In

the restricted contexts all 3- and 4-year-olds selected a response with apparent conviction, but in the unrestricted contexts they either responded correctly or answered "I don't know" or made no response. If only restricted tasks had been used in this study, the researchers would have concluded that the 4-year-olds comprehended the meaning of less as well as did the 5-year-olds. But their responses on the unrestricted tasks made it clear that they were at some intermediate level of competence between knowing the meaning of less in all contexts or in none. Wannemacher and Ryan state that the ultimate conclusion of their study is:

> the way young children interpret a word in a given situation reflects not only their linguistic knowledge, but also the operation of response biases, or nonlinguistic strategies elicited by particular task contexts and experimental procedures (p. 667).

This conclusion seems to apply to all of the studies discussed in this section and is extremely important in applying the research results and conclusions to new and novel situations.

Further evidence of this was reported by Donaldson and McGarrigle (1974). In investigating children's meaning of more and all they point out that children shift the basis for their judgments when confronted with different tasks. When 4-year-olds were shown two rows of cars, one with four cars and one with five cars, 34 out of 40 children chose the larger set when asked which row had more. When two garage structures, one with space for six cars and one with space for four cars, were positioned over the rows of five and four cars respectively, 13 children changed their response to more by choosing the set of four because

it was full. An example of the children's reasoning was expressed by one child who said: "There's more on that shelf (pointing to the smaller subset) because there's enough to go in there" (p. 189). In none of the other studies reported was fullness investigated as a variable that might influence children's ability to use more correctly.

In conclusion, young children learn the meaning of more prior to learning the meaning of less. In a forced choice situation it might appear that children are using less as if it means more. This might reflect their meaning of less or the restricted nature of the task. Responding to less as if it meant more is not a general pattern for all children across all tasks. Many of the researchers have tried to explain why more is so much easier for children. There seems to be some evidence that children have a perceptual preference for the set with more. There also seem to be some expected task-related behaviors on the part of the child that may be stronger than the linguistic directions. When a young child sees a tree with hooks and is shown some apples on the tree and some apples off the tree, it could be that it is more reasonable for him in terms of past experiences to add apples to the tree than to take them off, regardless of the directions. Eve Clark's (1973a) results in a series of studies of children's meanings of in, on, and under support the hypothesis that children first rely on nonlinguistic strategies in their acquisition of these terms. When given the directions "Put x in (on, under) the y," children always place x in y if it was possible, regardless of the direction, otherwise they placed x on y if it had a supporting surface. This makes it appear that children first acquire the meaning of in because by using this nonlinguistic

strategy they always perform correctly. In applying this observation to the research on more and less, Eve Clark (1973a) interprets the results to mean that at first children have an incomplete meaning for both more and less. They probably know that they both refer to amount; and they also have a nonlinguistic strategy of usually choosing the greater of two amounts. This would account for the children appearing to know the meaning of more and in seeming to treat less as a synonym for more. Some of Donaldson and Wales' (1970) reports of individual children's responses to some tasks lend support to the hypothesis that some children are using more and less to mean simply amount. Some children's replies to the question "Does one tree have more apples on it than the other?" were: "Both of them, that one does an' that one, both the trees, they two ones, and each tree" (p. 248).

Same/Different

Meanings of Same/Different

Same and different are adjectives that express relations. As a relation, same is characterized as being symmetrical, reflexive, and transitive. Different is symmetrical, irreflexive, and intransitive. Same and different as opposites do not resemble each other as relations as closely as do more and less which have the same relational properties.

There are various meanings of same and different. Webb, Oliveri, and O'Keeffe (1976) state:

> Same and different ... do not refer to any particular physical dimension but to an apparent infinite number of possible similarity relations generated by the speaker according to the physical or linguistic context (p. 984).

This makes it impossible to specify all variations of meanings of same and different.

Same can mean both identity and similarity. In the sense of identity same implies the identity of the self-same object. (See Donaldson and Wales 1970, for a discussion of philosophical questions inherent in this meaning.) In terms of similarity, two or more entities can be considered the same when: (a) they are alike in all observable attributes, i.e., "look alike"; (b) they are alike in at least one observable attribute but different with respect to at least one other observable attribute; and (c) they are alike in some respect(s) not directly observable. Donaldson and Wales (1970) further state:

> That the use of same does not always hold as a strong same relation in the language is pointed out by the fact that we have expressions like exactly the same, just as ... as, and the like (p. 256).

The meaning of different emphasized in some of the studies reviewed (Campbell and Wales, 1970; Webb et al., 1976; Wales, Garman & Griffiths, 1976) is that two or more entities are different when they are not alike in at least one way (they have at least one different observable attribute). In terms of this meaning of different and the "similarity" sense of same, two objects can be simultaneously the same in at least one way and different in at least one other way. This meaning for different also implies that the term different is appropriate when two or more entities share no observable attributes. In discussing children's choices on different tasks, some researchers seem to be of the opinion that this meaning of different is the "best" one. But of course, there is no linguistic theory which holds that one meaning is better than

another. The use of same and different is totally dependent on the context of the situation and the distinctions that one is trying to make. One problem in interpreting whether children's choices are correct or incorrect is the artificial nature of the research tasks and their lack of adequate context.

Different can also mean a denial of identity, hence in this sense any two objects can be considered to be different. Some researchers, though they acknowledge that this is a possible meaning of different, classify identical choices to the target as being incorrect. Yet Donaldson and Wales (1970) state:

> In everyday speech, sentences such as Give me a different one can--and commonly do--mean Give me another one that is of the same kind. In other words, the emphasis here is on difference in identity combined with some sort of similarity--and in this case, the phrase a different one is very close in meaning to the phrase another one (p. 250).

Same and different are definitely considered to be opposites. In terms of Lyons' (1968) three categories of opposites they best fit the category of complementaries (See page 5 in this paper). In order to show this, it must be kept in mind that these relations are always to be judged in respect to one or more specified attributes, then the following appears to be true: the denial of A is the same as B implies that A is different from B; and A is different from B implies the denial of A is the same as B.

Same and different are not polar adjectives as are more/less, big/little, long/short, and the other adjectives to be discussed in this paper.

When two objects are the same in terms of one or more attributes then the other adjectives do not come into a description of the comparison. But if the objects are different then the direction of the difference can be expressed with terms such as more/less, big/little, long/short, etc.

Research on Children's Meanings of Same/Different

The results of a much quoted study on children's comprehension of same and different by Donaldson and Wales (1970) have been interpreted by some psycholinguists as indicating that young children respond to different as though it meant same (e.g., E. Clark, 1973b, 1977a; Wannemacher and Ryan, 1978). In actuality the results of this study can be interpreted in two ways: (a) children comprehended different in the sense of a denial of identity, or (b) same and different were treated as if they were synonyms (Donaldson and Wales, 1970). It seems that because the second alternative is similar to the interpretation of research on children's acquisition of more/less and of some dimensional adjective pairs this has been the one adhered to by some psycholinguists. But interpreting children's responses in different comprehension tasks by claiming that children are acting as if different meant same is an oversimplification of a very complex linguistic situation. In Donaldson and Wales' (1970) study 3½-year-olds had no problems selecting an item from an array of 11 objects that "was the same in some way". When the children were instructed to "Give me one that is different in some way," most selected an item that was identical to the standard when such an object was present in the array or they selected an item that was similar to the standard in some way when no identical object was present. Because children avoided selecting objects that were different with respect to all observable attributes, the researchers state that the

children made no distinction between the directions "same in some way" and "different in some way". This is a very superficial view of the matter. As seen in the previous section of this paper, different has many diverse meanings. One meaning of different allows that "any two objects whatever are 'different in some way'" (p. 243). Donaldson and Wales (1970) actually acknowledge this in a footnote. Furthermore they even admit that as a consequence, all responses to the different tasks are correct choices. But they do not seem to want to accept the possibility that the children's meaning for different is in the sense of a denial of identity. Furthermore, their scheme for classifying responses has a category for choices that are different in at least one way. It seems from the discussion that even though "denial of identity" and "at least one observable different attribute" are correct adult meanings of different, they want the children to select objects that are different from the standard in all observable attributes.

Children's spontaneous use of the term different shows that children do use it in the sense of a denial of identity. The children's spontaneous use of the terms same and different were recorded for an eleven month period. Eighteen utterances including same were recorded, two of these also included different. Different was only recorded five times. In three of the utterances, different was used in the sense of a distinct one of the same kind: I've been to a different one, not the same as that. (Child is discussing a picture of a beach), a different seaside, and I'm going to mend the car, because it's a different car (Donaldson and Wales, 1970). A fourth utterance is ambiguous but it's possible that it could also have this meaning of denial of identity:

They're all the same but they're different, (the child is speaking about some books). This spontaneous use of different seems to be strong evidence that children do differentiate same from different.

Donaldson and Wales (1970) bring out a very important point when discussing the greater frequency of the use of the term same. Perhaps when children notice a difference between two entities they use terms that describe the specific difference; e.g., big, long, more, and old. In the discussion of the meanings of more/less the point was made that in order for children to correctly use and comprehend these terms they must first make an observation that the amounts or quantities are different.

In discussing Donaldson and Wales' (1970) results, H. Clark (1970) suggests that changes in the testing procedure would help clarify some of the results. The standard object used in the tasks could be replaced in the array prior to the child making a choice. Then it would be possible for the child to select the standard itself if his meaning for same was in the sense of "identity". In the different tasks the child could then select an object that looked identical to the standard but was not the standard itself.

Webb et al. (1976) used Donaldson and Wales procedures in a series of studies. In the first study 2- and 3-year-olds' comprehension of same, like, not like, and different were tested. Children responded in the same way to the terms same and like and to the terms not like and different. The objects used were identical to the standard or completely different from the standard. Twenty-three children were successful on most tasks; 21 children responded by choosing objects that looked identical to the standard in response to all terms. Four children who made no response to different indicated upon questioning that a correct response to different when shown a blue comb would be a pink comb or something similar.

Webb et al.'s (1976) second study conducted with 3-year-olds tested only their comprehension of different. Twenty of the 29 children always selected the most similar object in the array; the other nine were correct but only two children consistently chose a totally different object. Based on their results, Webb et al. (1976) suggest that children go through the following sequence of stages in their development of their meaning of different:

> (1) "different" is synonymous with "same"; (2) "different" means another member of a similar class (denial-of-identity explanation); (3) "different" means different with some basis of similarity; and (4) "different" means different with reference to both similarity and identity relations (p. 987).

Webb et al. (1976) carried out another study to see if they could find evidence to support their model. Twenty-four 3-year-olds were tested three times at approximately two month intervals using similar procedures. They claim that the children's choices and their reasons for their choices support their four-stage mode. In session 2 they incorporated in the tasks Clark's (1970) suggestion of returning the standard to the array. Only two children chose the standard itself when it was returned to the array; whereas five children chose the maximally similar object but not the standard itself. This indicates some support for the denial-of-identity meaning.

Wales et al. (1976) believe that young children can differentiate between the terms same and different. They state that this was not shown in previous studies because of the type of tasks employed and because the children's responses were analyzed in adult terms rather than their own. Tasks similar to those used by Donaldson and Wales (1970) were administered to 3- and 4-year-olds[2] to test their comprehension of same, not same, and different. One change

made in the procedure was that children were asked to continue selecting objects that were the same or different until they no longer responded or the set was exhausted. When color and shape overlapped, children were much more successful with selecting the objects that were not the same than in selecting objects that were different. The children had no trouble in making correct responses to same.

In all studies conducted by Wales et al. (1976) the results were similar to those of Donaldson and Wales (1970). But when each child [illegible]quences of responses for same and different or for same and not same were [illegible] only one child used the identical sequence for both. Wales et al. ([illegible] aim that this indicates that the children were responding differently to same and different or not same.

One consistent result of the previous studies was that the children had few problems understanding the term same. In other studies where different types of tasks were employed, children the same age or older were not as successful in responding to same. Beilin (1965) reports that only 47.6% of the kindergarten children tested could respond correctly to the question "Do you have more, less, or the same chips as I?" when shown two sets of six chips.

Griffiths et al. (1967) found that more and less were comprehended and used significantly more often by 4-year-olds than was same for length and weight comparisons. They were also more often correct in their use of the term same for length than for weight. There were no differences in children's frequency of production and comprehension of more/less and same for number tasks. Same was consistently used correctly across the three content areas of number, length, and weight by 40% of the children. Griffiths et al. (1967)

point out that the order of difficulty for comprehending and using same across the three content areas studied, length, number, and weight parallels the usual order of attainment of conservation concepts.

Harasym et al. (1971) report the results of first-, second-, and third-graders' judgments of same and different on a semantic differential by using Scale D scores. D scores reflect the comparison of individual children's rating of the two terms. D scores can range in value from 1, indicating identical choices for both terms, to 16, indicating opposite polar choices. Profiles of mean scores were presented to show the results of using the semantic differential for the terms more/less. A similar presentation for same/different would have been more informative. Children categorized as logical conservers had small D scores for same/different (1.5) and large D scores for more/less (7.3) on the concrete scales described elsewhere in this paper. Children classified as nonconservers had similar D scores for both pairs of words. It is questionable if this procedure of using a semantic differential with these particular scales is appropriate for investigating the meaning of same and different. I would find it very difficult to rate different on such scales. Consider the scale long/short. On a five point scale, I would select 3 as being my response for same but I have no idea what to select for different. I would like to choose 1 and 5, but I'm limited to one choice. What are children expected to do? Is it expected that children would mark these as opposites, selecting to associate same with long or short and different with the end of the scale not chosen for same? But as was previously pointed out in the discussion of opposites same/different are complementaries rather than antonyms. Whereas more/less, long/short, and the adjectives representing the other five scales are all antonyms.

Because of the manner in which the data is presented and the relationship of the rating scales to the terms same/different, it is difficult to interpret this study. It does not seem to add much to our knowledge of children's meanings of same/different.

In conclusion, young children seem to have a better understanding of the term same than of the term different when comparing like and unlike objects. But there are problems with the designs of the studies that produced these results. The selection of an object in a same or different comprehension task might not give us much information concerning a child's meaning of these terms because of the many various ways in which these terms may be used. The researcher might have one interpretation in mind while a child interprets it another way. The lack of adequate context and the child's inability to verbalize the basis for his choice might lead to false conclusions about the child's meaning of the term being tested. An important consideration in designing further studies to probe children's meaning of same/different would be to create a more adequate context where the criteria for correct choices were made more explicit.

There are contradictory results as to 4- and 5-year-olds' success in correctly identifying sets with the same numbers. Beilin (1965) states that less than half of the children tested were successful, whereas Griffiths et al. (1967) report a 72% success rate with younger children. They also claim that more/less and same are of equal difficulty in number tasks, but Palermo (1973) claims same is known by fewer children than is more but is easier than less. These conflicting results need to be resolved with additional research in this area.

Some of the research on the terms same and different is beset with serious design and interpretation problems. Because of the range of meanings inherent in these terms, it is important in future research that a fuller sampling of this range on diverse tasks be carried out. Many different types of production and comprehension tasks need to be designed that provide a clear context for interpreting the results. Of course, the most relevant type of data to collect would be children's spontaneous use of the terms over a long period of time.

Dimensional Adjectives

Meanings of the Dimensional Adjectives

The dimensional adjectives, also called spatial adjectives, to be discussed in this paper are: big/little (or small), long/short, tall/short, high/low, wide/narrow, deep/shallow, and thick/thin. The dimensional adjectives comprise a semantic field. Terms that are members of the same semantic field share some of the same semantic features, i.e., terms in a semantic field are related to each other in meaning. The semantic feature [Spatial Extent] is shared by all terms in this semantic field. Other semantic features shared by subsets of this field are [± Polar]. The dimensional adjectives come in antonym pairs that differ in polarity. The first term listed in each pair has the semantic feature [+ Polar] and the second term listed in each pair has the semantic feature [- Polar].

Each pair of dimensional terms is associated with one of the following dimensional scales: size, length, tallness, height, width, depth, and thickness. Except for the pair big/little, the first member of each pair is used as the basis for each scale name. Each scale is measured from some primary reference

or zero point. The first element in each pair labels the positive direction away from the primary reference point and can also be used in a neutral sense in discussing the dimension. For example, in "How long is that board?", long is used in a neutral sense indicating the scale of length. When used in a contrastive sense, the positive term indicates that the object being discussed is greater in extent than a standard for that particular class of objects. This standard that is particular for each class determines a secondary point of reference on each scale. In the sentence "That is a long board.", long indicates that the length of the board is greater in extent than some standard board, i.e., the board extends beyond the secondary standard point. The negative term is used only when measuring from the standard point back to the zero point; hence the negative term cannot neutralize to extend to the whole scale. In "That is a short board.", short indicates that the length of the board is less than the standard board. The use of the positive term in measure phrases further demonstrates the neutral use of the positive term, "two hours long", can be used but not "two hours short". Because the positive term can at times be neutralized to denote the whole scale, it is considered to be "unmarked" and the negative term is considered to be "marked" (cf. Greenberg, 1966; Bierswich, 1967; H. Clark, 1970, 1973).

The terms big and little (small) differ from the other antonym pairs in that they are more general in meaning, i.e., fewer restrictions are placed on their use: they can be used to refer to one-, two-, and three-dimensional objects. Hence they can be used in many circumstances that overlap the usage of the other adjectives in the semantic field. In some sense big/little are superordinate to the other adjectives in this field. "The dimension of comparison underlying big and little is spatial extent alone; all other spatial

relatives require further features for their specification, such as [vertical]" (Carey, 1978, p. 277). Therefore, all of the other terms are more specialized in meaning; and have more semantic features and restrictions for their use, they are semantically more complex. Bierswich (1967) has identified other semantic features that further differentiate between terms in the field of dimensional adjectives. Even though all dimensional adjectives share the semantic feature [Spatial Extent], big/little apply to [n-Space] whereas the other adjectives in this field refer to only one particular dimension [1-Space]. This one dimension can be further specified in terms of [+ Vertical]. Also when describing two- and three-dimensional objects some dimensions are not used to name the most extended dimension of the object; these have the added semantic feature of [+ Secondary]. In terms of this analysis some examples are: long/short have the semantic features [1-Space], [- Vertical] and wide/narrow have the semantic features [1-Space], [- Vertical], and [+ Secondary] (E. Clark, 1972).

All the dimensional adjectives can be used in a relative sense. The unmarked dimensional adjectives can also be used in a nominal sense (neutral sense). All of these adjectives have a comparative form and a superlative form, marked by the morphemes -er and -est, respectively.

Some of the research to be reported in the next section investigates children's comprehension and production of some or all of the dimensional adjectives discussed. Other studies also focus on the comparative and superlative forms of these adjectives.

Research on Children's Meanings of Dimensional Adjectives

Many investigators have chosen to study children's acquisition of dimensional adjectives because they form a semantic field--"in the linguistic system of adults these adjectives form a closely-related and highly structured set" (Wales and Campbell, 1970, p. 374). They are interested in answering questions such as: "Which terms are acquired first?" and "What are the linguistic characteristics of the terms, e.g., semantic complexity and polarity, that cause some terms to be acquired before others?"

Early studies on children's acquisition of dimensional adjectives were undertaken to discover the relationship of children's language and their cognitive level as determined by Piagetian tasks. Sinclair-de-Zwart (1969) reports that there was no difference in comprehension of the comparative form of dimensional adjectives by conservers and nonconservers. But there was a difference between the two groups on production tasks. On one production task children were shown two pencils, a short, thick one, and a long, thin one, and asked to tell the difference between the two pencils. All of the conservers used specific terms to describe the two varying dimensions; 80% also used two sentences, coordinating the two dimensions, e.g., this pencil is long(er) but thin(ner), the other is short but thick. Seventy-five percent of the nonconservers used one undifferentiated term for the two dimensions; and 90% used only one term, or used four separate sentences, to describe the differences, e.g., this pencil is long, the other is short, this pencil is thin, the other is fat.

In a second experiment reported by Sinclair-de-Zwart (1969), nonconservers were taught the terms and the coordinated description of a difference in two

dimensions used by conservers. She states that it was easy to teach the terms but difficult to teach the coordinated structure. Only 10% of the children acquired conservation following the language training; but while doing the conservation tasks more than half of the continuing nonconservers used their newly acquired terms in describing the salient dimensions, e.g., higher level, narrower glass (cf. Sinclair-de-Zwart, 1967, for a complete description of the studies).

In a similar study of the relationship of language production and conservation by Farnham-Diggory and Bermon (1968), conservers spontaneously verbalized both dimensions more frequently than did nonconservers. A problem in interpreting the results of both of these studies is that age was not controlled for. In both studies the conserver group was older than the nonconservers. The relationship of the ability to conserve and language development would be clearer if the two groups had been the same age. It is generally accepted that older children have a larger vocabulary and use more advanced syntactic structures than do younger children, so this is an important limitation to both studies.

Ehri (1976) studied both adjective development of 4- to 8-year-olds and the relationship of their linguistic abilities and their success on Piagetian seriation tasks. Several measures of children's comprehension and production of some dimensional and other adjectives were obtained, as well as a measure of their ability to seriate. The results that pertain to the relationship of language and seriation will be presented at this time as it relates to this question of age and cognitive level. The results that pertain solely to

adjective development will be presented later in the paper as a number of studies that preceded it need to be discussed in order to better integrate Ehri's results with that body of literature on children's acquisition of dimensional adjectives.

Ehri (1976) identified three groups of children based on their performance on the seriation tasks: younger non-seriators (n = 9, age 4-5), younger seriators (n = 5, age 4-5), and older seriators (n - 21, age 6-8). Significant differences on various comprehension and production tasks were found between younger non-seriators and younger seriators, and between younger seriators and older seriators. It is important to view both sets of differences in order to sort out which differences are a result of age and which are a result of advanced cognitive level.

Significant differences between younger non-seriators and younger seriators are:

1. Seriators produced more specific adjectives when shown 15 pairs of objects that were identical except for the target dimension. Adjectives tested were: large, fat/skinny, long/short, tall/short, more/less, many/few, heavy/light, and hard/soft.

2. Seriators comprehended more coordinated forms, e.g., "Are there any buildings that are fat and short?"

3. Seriators comprehended more comparative-equative forms; e.g., "bigger than", "not bigger than", "as big as", and "not as big as". Only the terms big and little were tested.

Differences on measures of production similar to those used by Sinclair-de-Zwart (1967, 1969) and Farnham-Diggory and Bermon (1968) were not significant. Perhaps this is a result of the fact that the children in Ehri's study are younger than the children in the other two studies; and Ehri's two groups are approximately the same age.

The significant differences between the younger seriators and the older seriators are:

1. The older seriators were superior in vocabulary production on an Opposite Elicitation Task. Children were presented with 32 antonyms and asked to give their opposites.

2. The older seriators produced more specific adjectives on the Object Description Task.

3. The older seriators comprehended more coordinated forms.

4. In describing seriated objects, the older seriators produced more comparative forms and fewer polar terms.

These results lend support to the conclusion that increase in adjective production is probably related as much to age as to cognitive level.

Beginning in 1970 many studies focusing on children's meanings of dimensional adjectives were undertaken that did not also include Piagetian tasks. Wales and Campbell (1970) tested children's comprehension of the comparative and superlative forms of the adjectives big/wee, (wee is used in Scotland instead of little.) long/short, thick/thin, high/low, tall/short, and fat/thin, and tried to elicit production by asking the children questions about a set of pictures that were placed in the context of a story. Two experimental groups

were given training over two school terms, one experimental group (E1) was encouraged to justify their responses while the other group (E2) was not. The two experimental groups and a control group were then retested using the same tests. One problem with the report is that the training is not adequately described. All that is included in the article is: "The training was based on perceptual matching tasks for the first term and on perceptual transformation tasks for the second term" (p. 377). It would be difficult to replicate the study based on this information. Donaldson and Wales (1970) report some of the results of the pre-test. Children responded correctly significantly more often to the positive adjectives than to the negative ones. This occurred more often for superlatives than for comparatives. When children were asked to choose a second object in response to a comparative they were seldom able to do this even though another choice was always possible. In order to discover if children were using comparative and superlative forms as synonymous, single correct first responses to comparatives were analyzed. Only 43% were choices of the extreme item, so children were differentiating between comparatives and superlatives. There were no significant group differences on the pre- and post-tests on comprehension of superlatives; but some slight improvement was shown on the post-test by all three groups. There were slightly more correct responses to the first comparative instruction on the post-test than on the pre-test. The important change was that there was an increase from 54 to 151 correct responses to the second comparative instruction from the pre-test to the post-test. An increase occurred in all groups but was greater for the E1 group, although not significantly so. Wales and Campbell (1970) suggest an

explanation of children's tendency not to select the extreme choice in response to a comparative. They hypothesize that when children first differentiate between the comparative and superlative forms they are unaware of the overlap in their usage.

One result of the production test was that more adjectives were used on the post-test than on the pre-test by all three groups; with big and wee being the most frequently used on both tests. There was an increase in the use of specific dimensional adjectives by all three groups but only a few of these were negative adjectives. The importance of this study is the description of children's comprehension and production of dimensional adjectives rather than the effect of the training on the two experimental groups.

E. Clark (1972) tested 4- and 5-year-olds' ability to produce its opposite when given a dimensional adjective. There was a significant difference for three age groups favoring the older children. Half or more of the older children knew all of the terms; very few of the youngest children could respond to the more complex terms--especially difficult were thick/thin, wide/narrow, and deep/shallow. There was a very high linear correlation between the positive and the negative terms in each antonym pair. E. Clark concludes that this, together with the lack of significant difference between the two terms in a pair, shows that the pairs are learned together. Another very important finding was that the most common substitution made was a semantically simpler term for a more complex one but not vice-versa. Big was substituted for tall, long, high, old, thick, deep and wide; and small or little was substituted for low, narrow, thin, and young. The order of acquisition based on correct responses is: (a) big/

small; (b) tall/short, long/short; (c) high/low; (d) thick/thin; and (e) wide/narrow, deep/shallow. This ordering corresponds directly to the relative semantic complexity of the terms.

Klatzky, Clark and Macken (1973) designed a training study using three letter nonsense words (CVC's) to replace the adjective pairs: big/small, high/low, long/short, and thick/thin. Their purpose was to test whether the positive adjectives in antonym pairs were learned first by children because of a conceptual basis or because they are more frequently used by adults. The major result was that children were more successful in responding correctly to the positive CVC's than to the negative ones. Since the children were given the same opportunity to learn both terms of a pair, the conclusion was that the pattern of acquisition was due to a conceptual basis. (See Klatzky et al., 1973, for their description of the differences in complexity in positive and negative comparison situations that underly this asymmetrical usage.)

Eilers, Oller, and Ellington (1974) investigated the comprehension of big/little, long/short, and wide/narrow by children younger than were previously studied--2- and 3-year-olds. The order of predicted difficulty was supported by the data and was the same as that reported by E. Clark (1972). The other major result was directly contrary to all previous results obtained in investigating dimensional pairs. Significantly more errors were made on positive terms (big, long, and wide), than were made on negative terms (little, short, and narrow).

In order to discover if the children's responses were due to their natural preference for the smaller item, Eilers et al. (1974) conducted a second study.

The results of the test for size preference were significant with children more often choosing the objects that corresponded to the negative adjective, i.e., the smaller objects. Therefore, many of the children's choices on the first study might be attributed to nonsemantic preference. When size preference was controlled for, there was no significant difference in performance between positive and negative terms in each antonym pair.

Brewer and Stone (1975) tested children's comprehension of the 12 specific dimensional adjectives by using a task containing objects representing two independent dimensions. This design was chosen to make possible a discrimination between children's knowledge of the dimensions being tested and his knowledge of polarity. The most common error made was to choose the exemplar for "the different dimension, same pole", rather than for "the same dimension, opposite pole"; this difference was significant. In studies where all choices vary only on the dimension being tested this discovery could not be made. Based on this result, Brewer and Stone (1975) conclude that polarity features are learned prior to the features that underly the dimension. E. Clark's (1972) results also support this conclusion. Another result reported by Brewer and Stone (1975) was that the positive adjectives had significantly more correct responses than did the negative adjectives. Therefore, the positive polar feature is learned prior to the negative polar feature. When adjective pairs are ordered based on number of correct responses, the order is the same as that reported by E. CLark (1972) and Eilers et al. (1974).

When Bartlett (1976) investigated 3- to 5-year-olds' comprehension of the terms big/little, long/short, tall/short, and wide/narrow, she also found that they were acquired in this same order. There was no significant difference in

children's comprehension of the positive and negative terms when single dimension stimuli were used; but positive terms were significantly easier when double dimension stimuli were used. With both sets of stimuli there was a significant age difference favoring older children. Bartlett (1976) next tested children aged 2-3 years on their comprehension of big/little in order to acquire some insight into children's initial acquisition of polar features. There was no significant difference in the number of correct responses to the two terms. But when examining the data it was found that all of the children who attained perfect scores on big did the same on little. Four children who attained a perfect score on little did not attain a perfect score on big. This trend in the data is reminiscent of Eilers et al.'s (1974) results with children of the same age.

One continuing question in the study of language acquisition is the relationship between comprehension and production of terms. Ehri (1976) reports that 4- to 8-year-olds do not generally use coordinated forms of two adjectives until they can comprehend such structures, e.g., He has more marbles but they are smaller. The reverse is true for comparative forms of adjectives. Children produced comparatives even though on the comprehension tasks they did not understand their meaning. Another observation made by Ehri (1976) concerning coordinated forms of two adjectives was that children up to 8 years old might mention the two dimensions by which two objects differ; but it wasn't until children were 8 years old that they integrated both variations into one linguistic form.

Ehri (1976) claims that some of the children were using the term bigger as if it meant big. This was further demonstrated when children were asked to state the differences in sets of five seriation objects. Some children correctly used pointing with correct comparative statements. Some children responded by combining adjectives in their standard or comparative forms with modifiers, e.g., a middle object was called kind of bigger, and between bigger; a different child called the biggest object bigger and then the next one in size a little bigger.

The results of the research reviewed on children's knowledge of dimensional adjectives are fairly consistent. Children appear to know that these words are in some way related. They are consistent in the order in which they acquire meaning for the seven antonym pairs. When they become aware of a new pair in this semantic field they seem to associate the positive term with big and the negative term with little or small. Hence, polarity seems to be acquired before the various dimensions are sorted out. The task of associating the correct antonym pair with the correct dimension seems to take many years. In any given antonym pair, the positive term is usually better known than the negative term. This is also true for comparative and superlative forms of these adjectives.

Some children have a size preference that influences their choices in comprehension tasks. It has generally been thought that this preference is always for the larger object, but Eilers et al. (1974) report that 2- to 3-year-olds prefer the smaller objects. Identifying nonlinguistic preferences of children is very important in interpreting the results of language comprehension research.

Discussion

Only one small aspect of children's language development has been examined in this paper--children's meanings for a very few but important terms. Admittedly, there are many limitations to the research reported. This is due to the difficulties of trying to infer word meaning from children's responses to directions and questions, as well as to the problems of trying to get children to produce specific terms in contrived situations. Yet from this research, several general and specific trends are worth noting.

Children's first meanings for the terms reviewed were shown to be different from those of adults. They are different in several ways. One possibility is that they are incomplete; another is that children sometimes incorporate additional features as part of their meaning that are not part of adult meanings. One example of this is children's use of fullness as a feature of more reported by Donaldson and McGarrigle (1974).

Because these terms apply to many different contexts from simple to complex, there are times when children, who have an incomplete meaning for a term, appear to comprehend the term and to use it correctly. So if knowledge of these terms is important in understanding the questions being asked in Piagetian tasks or in investigations of mathematical concept development, then it is not enough to test children's knowledge of these terms on just any comprehension task. One must ascertain children's meanings of the terms in situations requiring the same linguistic complexity as the cognitive task. This applies to diagnosis of children's knowledge of mathematical concepts as well as to research. In some respects it is not as crucial in a good teaching situation. For during instruction, the children--those avid language learners--are able

to use the whole context from which to abstract the meaning of the crucial terms being used. Especially if the learning situation is a rich context with lots of talking and gesturing by teacher and students, and many manipulative materials to help clarify the points being made.

This lack of full meaning for words exists for many other terms besides those discussed in this paper. As this research shows, with age and experience, children do learn the full meaning of words for which they previously had partial meaning. An important point is that children are constantly being exposed to new words. So at any given time there exist words in their lexicons for which they have only partial meanings. This is true for adults as well as children.

As researchers, diagnosticians, and teachers, we need to become more sensitive to this phenomenon of developing and expanding word meaning. The best clue to children's meaning of terms comes from their spontaneous use of them. So we need to listen more to children in natural language contexts. This can even occur in a mathematics classroom.

The terms more/less and same/different are crucial in discussing many mathematical relations. These four terms and the dimensional adjectives are also necessary in discussing classification and seriation activities and beginning measurement concepts. Therefore, teachers of young children should be aware of the many diverse situations in which these terms may be used. Then they can plan activities that not only focus on correct answers, but that also require children to describe and justify their responses.

Holland and Palermo (1975) were surprised at how fast children learned to differentiate between less and more, when they were taught together. Perhaps

a similar strategy would help children to learn the negative dimensional adjectives. This procedure of using both terms in an antonym pair, in describing the same situation so that their differences are emphasized, seems worth exploring.

During this century mathematics educators have become aware of the importance of children's cognitive structures in their learning of mathematics. Mathematics curricula have been designed based on learning theory and child development. With the current surge of research in the area of child language acquisition, it is time to begin to investigate how children's linguistic competence affects their learning of mathematics. This review of children's meanings of some terms that are part of the "language of mathematics" will hopefully help mathematics educators become more aware of one aspect of children's linguistic development.

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Footnotes

[1]The matching of positive with the unmarked unit and negative with the marked unit varies from other uses of these terms. "It is frequently the case that of two units in contrast...one will be positive, or marked, the other being neutral, or unmarked" (Lyons, 1968, p. 79). For example, in the case of the singular and plural forms of some nouns, the plural form is positively marked with a final s, and the singular form is neutral and unmarked.

Also see Greenberg (1966) for a discussion of the marked and unmarked categories as they relate to phonology, syntax, and semantics.

[2]Campbell et al. (1976) tested children from three different language and cultural groups: English speaking children from Edinburgh, Scotland; Tamil speaking children from Chidambaram, Tamilnadu, India; and Lun Bawang speaking children from Long Sebangang, Sarawak, Borneo. Only the results of the English speaking group will be discussed in this paper.